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NOTES ON CIRCULATION OF SAP.

BY W. R. LIGHTON.

I wish to call your attention briefly to some of the results obtained in the performance of several experiments upon the sunflower, bearing upon a question of considerable interest—the circulation of sap.

First, in the early spring, when the stalks of my more vigorous plants had attained a diameter of about three-quarters of an inch, I had recourse to a venerable experiment—the simple binding of a string tightly about the stem.

In several of the plants selected the growth was so vigorous and the bark so tender that as the stem increased in size the string cut through and was imbedded in the tissue beneath; but in several other cases the experiment was a success.

After the operation of tying, the stalk continued to develop normally above the ligature, except for a space of about two inches immediately above it, where there was an abnormal increase in the size, while careful measurements showed that further growth below the string was almost entirely checked.

This partial stoppage of the circulation apparently did not interfere in the least with the process of maturing of the plants, as they went on uninterruptedly to the completion of their mission, and reached the periods of flowering and seeding at the same time as did their brothers with which I had not interfered, and there was no noticeable decline in the vigor of the leaves and branches above the stricture—in fact there were many of the plants which were growing within a few feet and not subjected to the tying process which were much less healthy in appearance.

When further growth of the stalks had stopped I made careful measurements, which showed that the average height of the tied plants was equal to that of the plants not tied, some of them reaching a height of fifteen feet.

As before stated, the growth of the stalk below the ligature was almost, or quite stopped, the circumference at this place in the larger stalks being but $2\frac{1}{2}$ to 3 inches, while the circumference about a foot above the place of binding was from six to eight inches in the same plants, and the circumference at the point of abnormal development above mentioned was from eight to eleven inches.

A number of dissections and microscopical examinations made after six weeks of growth under these conditions showed that the stalk below the place of binding had an extremely small quantity of cellular tissue in its composition, but was composed almost altogether of the vascular or woody tissue, while the stalk above showed, as compared with other stalks in normal condition, the usual development of cellular tissue, while the enlargement just above the ligature showed an excessive development of the cellular tissue.

Other stalks were tied later in the season, before the time of flowering, but when the stalks had attained to almost their full size, but these effects were not observed, with the exception of one case where there was a slight enlargement.

As you know, in the performance of a surgical operation it frequently becomes necessary to tie an artery or large vein to prevent loss of blood, and in such case the flow of blood thus stopped is diverted into other channels, and the smaller veins or arteries having their duties thus increased, are increased in size and strength in proportion.

Early in the season while the flow of sap was strong in the young plants, several experiments were tried which gave results that would seem to approximate those obtained in surgery under the conditions named above, although it is generally acknowledged that there is no exact parallelism between the flow of sap in plants and the arterial and venous circulation in animals.

Rectangular incisions were made averaging one-third of an inch in width and extending two inches lengthwise of the stem and of varying depth, some simply extending through the outer bark, others slightly into the woody fiber, and others to the heart of the stem.

The cut surfaces were speedily healed in the ordinary way, leaving the rectangular opening, and the sap which formerly flowed through the severed tissues was forced to find other channels.

When the incision extended only through the outer walls of tissue, an enlargement occurred at the upper end of the wound, being immediately at the sides of the cut, rather than above it, as would be the case if it were simply an enlargement resultant upon the severing of tissues, while when the incision extended deeper into the woody tissue this enlargement occurred at both the upper and the lower ends of the incision. Dissection and examination showed a slight increase in the amount of cellular tissue just surrounding the wound, as would be expected from the healing. Perhaps twenty plants were thus treated at the same time, always with the same result.

In other cases small splinters of wood, bits of wire and other foreign substances were forced into the stalk, and in such cases these substances were enfolded by the aggregation of a considerable amount of cellular tissue, or, in a manner, they would be encysted.

These few experiments, rude and incomplete from a strict scientific point of view, and undertaken when I had not time to follow them up as carefully as I could have wished, have yet yielded some curious results, and have suggested other experiments which shall be made during the coming year.

PERSONAL OBSERVATIONS UPON THE FLORA OF KANSAS.

BY MRS. A. L. SLOSSON, LEAVENWORTH.

The flora of Kansas has received considerable attention for some years, and many lists more or less comprehensive have been published. None of these even in the judgment of the compilers have been at all complete, and from the very necessities of the case, being more or less local, were limited in their range, and untrue in some of the general conclusions.

The location of Kansas being central, its vegetation partakes of the North and the South, of the fertile prairies of the East and the barren plains of the West; and though it may lack the plants that require the mountains for their home, yet our variety of soil gives us also a great variety of plants, and our long seasons and genial climate promote their growth. Our flora, moreover, is rapidly changing from various causes, among which are cultivation and the introduction of new plants, climatic changes, freedom from prairie fires, and the increase of timber and hedges.

It is a well-known fact that where the prairie sod is once destroyed it never reappears, but an entirely new and different vegetation comes, which is nearly the same in any given locality. An illustration of this that I never heard explained occurred after the last grasshopper raid in northern Kansas. The grasshoppers ate the grass to the roots in the fall, and in the spring kept it down until mid-summer, so that where it was trodden at all, as in yards, by the roadsides, and such places, it was entirely killed; even where it was blue-grass, that too shared the same fate; but late the next season the soil was covered thickly with a soft, low, pale grass unlike any that had ever been seen there before. The farmers called it "grasshopper grass,"